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5-31-69

A Cloud of Questions Hovers Around Carbon Monoxide

CARBON MONOXIDE, a treacherous, poisonous gas produced by the incomplete combustion of gasoline, coal and other fuels, is produced and released into the earth's atmosphere at a yearly rate of almost a quarter of a billion tons—about the mass of the human population.

About 85 per cent of the total comes from automobile exhausts.

We know of many thousands of deaths from acute carbon monoxide (CO) suffocation, including suicides and accidents from fires in unventilated rooms. Nevertheless, many questions remain on the general significance of the CO load to human health.

THE MAIN EFFECT of CO in the body comes from its very high affinity for the oxygen-carrying pigment, hemoglobin, in the red blood cells. It will displace oxygen there with an efficiency of 218 to 1, so that relatively small concenrations of CO will prevent the blood from carrying oxygen to the tissues.

The reaction is reversible, so that CO will be re-emitted over a period of a few hours if polluted air is replaced by fresh air. But the larger problem is the extent of chronic damage to the tissues, especially the heart and the brain, if these are subjected to periodic stress through lack of oxygen.

This has not as yet been related to long-term toxicity. Population studies are also hindered by difficulties of separating the CO factor from other aspects of air pollution and urban life. The city dweller today is only periodically exposed to more than about 20 parts per million of CO, which corresponds to a blockade of 3 per cent of his hemoglobin, but surges over 100 parts per million are not uncommon—with even higher levels in tunnels, garages and other enclosed spaces. Heavy smokers inhale large amounts of CO and will have 5 or 6 per cent of their hemoglobin blockaded by it.

THESE ARE NOT necessarily serious insults to the otherwise healthy person, but we can hardly take complacent a view for the person who is already stressed by other disease, by pregnancy, by physical exertion or by working at high altitudes.

In a sense, the toxicity of CO is a witness to the slow pace of biological evolution. The affinity of hemoglobin for CO would have been immaterial before the discovery of fire some 50,000 years ago; but even primitive man must have been penalized by CO suffocation from smoky fires in caves. We have, nevertheless, still to evolve a hemoglobin better suited to the industrial era by showing better discrimination against CO.

A hint of such a development is suggested by a recent report from the U.S. Naval Medical Research Institute that the affinity factor for fetal blood is only 172 to 1.

All such studies, however, need to be re-examined in the light of recent discoveries by Drs. Reinhold and Ruth Benesch of Columbia University Medical School, New York. They have found that the oxygen-affinity of hemoglobin within the red blood cell is regulated by an intermediate product of sugar metabolism, diphosphoglycerate. The body's ability to produce this material, and its relative effect on the affinity of CO and of oxygen, may be all important in how well a given citizen can tolerate the CO in his environment.

UNLIKE other industrial effluents, carbon monoxide is not a cumulative pollutant on a global basis, and it appears to reach an equilibrium in the overall atmosphere at levels well under one part per million. This implies some pervasive process for getting rid of CO.

What this is has not yet been worked out; the obvious suggestion that CO is spontaneously burned in the atmosphere to carbon dioxide (CO_2) does not now seem likely. The most likely possibility is that some microbes, more widespread than we now recognize, can metabolize the CO efficiently; or else that many organisms can do so at a very low rate, but enough to balance the world's production. The fact that many organisms, including man, produce trace amounts of CO as a byproduct of normal metabolism lends some weight to this view.

It is important that we do discover the actual fate of CO in the atmosphere before we accidentally upset the process of its removal, as we might do as an unforeseen side effect of other lines of technological progress.